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(54) **CONTACT CENTER MESSAGING**

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(51) **Int. Cl.**

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G06F 9/54	(2006.01)
G06N 20/00	(2019.01)
H04L 51/222	(2022.01)
H04L 67/1001	(2022.01)

(52) **U.S. Cl.**

CPC ***H04L 51/06*** (2013.01); ***G06F 9/542*** (2013.01); ***G06N 20/00*** (2019.01); ***H04L 51/222*** (2022.05); ***H04L 67/1001*** (2022.05)

(58) **Field of Classification Search**

CPC ... H04L 51/06; H04L 51/222; H04L 67/1001; G06N 20/00; G06F 9/542

See application file for complete search history.

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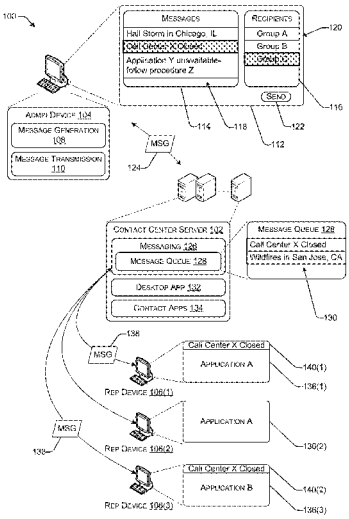
(57) **ABSTRACT**

Techniques described herein relate to message distribution in a contact center. Messages generated by an administrator and/or by a trained model processing data from customer interactions with the contact center are stored in a message queue. A desktop application running on a representative device and hosted by the contact center queries the message queue for messages intended for a representative using the representative device. Messages intended for the representative are automatically displayed on the representative device, e.g., on the desktop.

24 Claims, 7 Drawing Sheets



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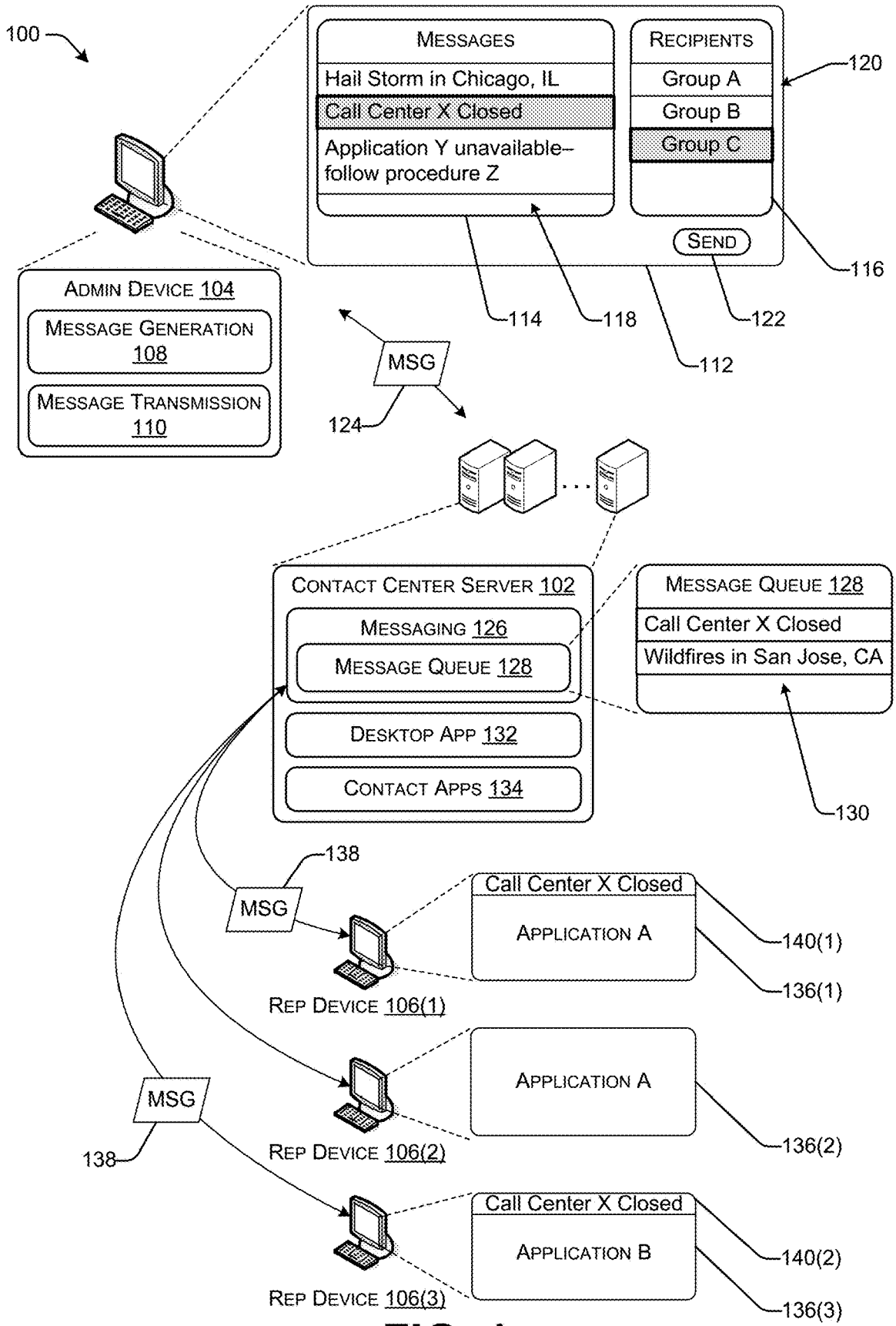
100
MESSAGES
Hail Storm in Chicago, IL
Call Center X Closed
Application Y unavailable–follow procedure Z
RECIPIENTS
Group A
Group B
Group C
120
SEND
116
114
118
122
112
ADMIN DEVICE 104
MESSAGE GENERATION 108
MESSAGE TRANSMISSION 110
MSG
124
CONTACT CENTER SERVER 102
MESSAGING 126
MESSAGE QUEUE 128
DESKTOP APP 132
CONTACT APPS 134
MESSAGE QUEUE 128
Call Center X Closed
Wildfires in San Jose, CA
130
138
MSG
Call Center X Closed
APPLICATION A
140(1)
136(1)
REP DEVICE 106(1)
MSG
138
APPLICATION A
136(2)
REP DEVICE 106(2)
Call Center X Closed
APPLICATION B
140(2)
136(3)
REP DEVICE 106(3)

FIG. 1

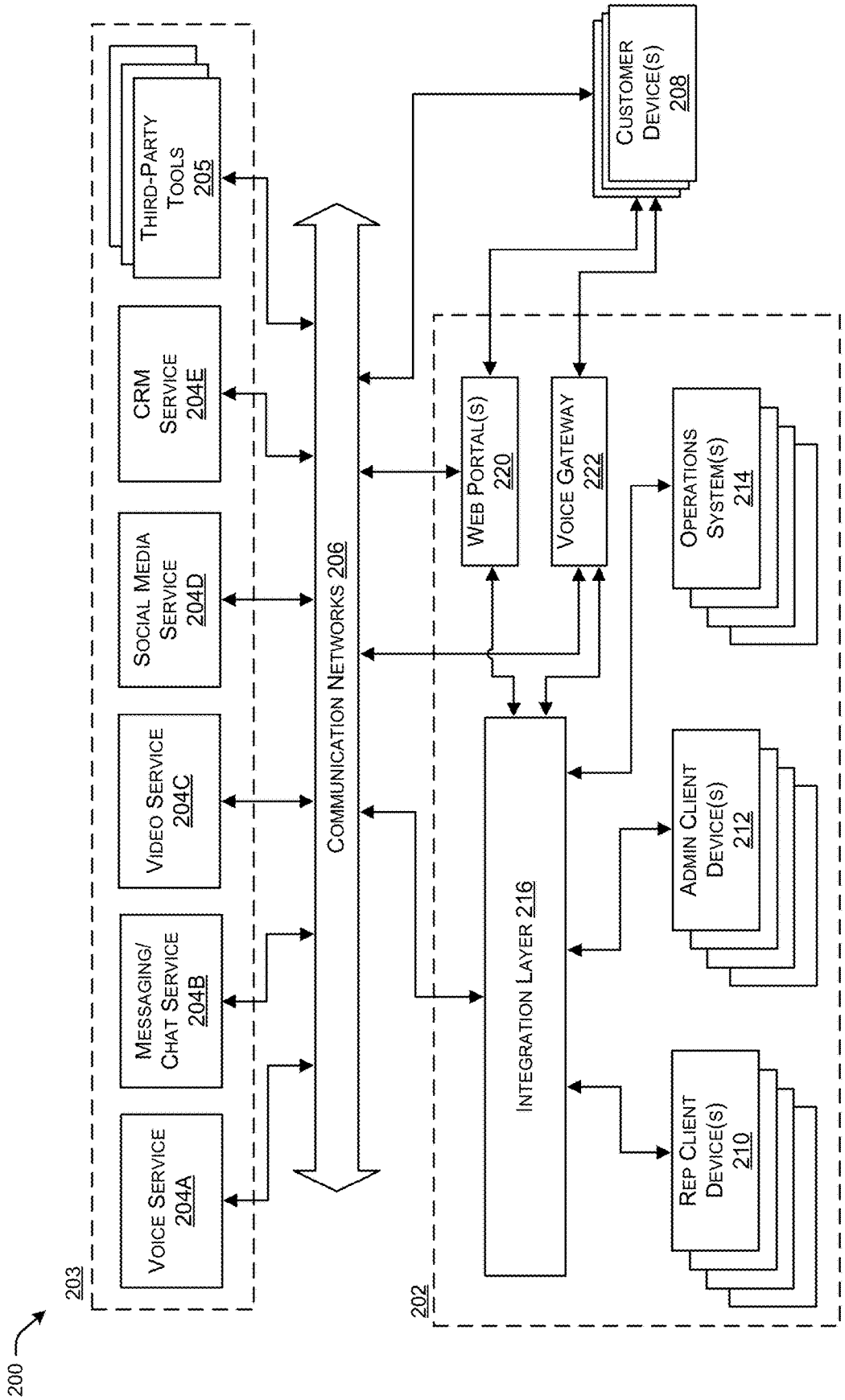
200
203
202
Voice Service 204A
Messaging/ Chat Service 204B
Video Service 204C
Social Media Service 204D
CRM Service 204E
Third-Party Tools 205
Communication Networks 206
Customer Device(s) 208
Web Portal(s) 220
Voice Gateway 222
Integration Layer 216
Operations System(s) 214
Admin Client Device(s) 212
Rep Client Device(s) 210

FIG. 2

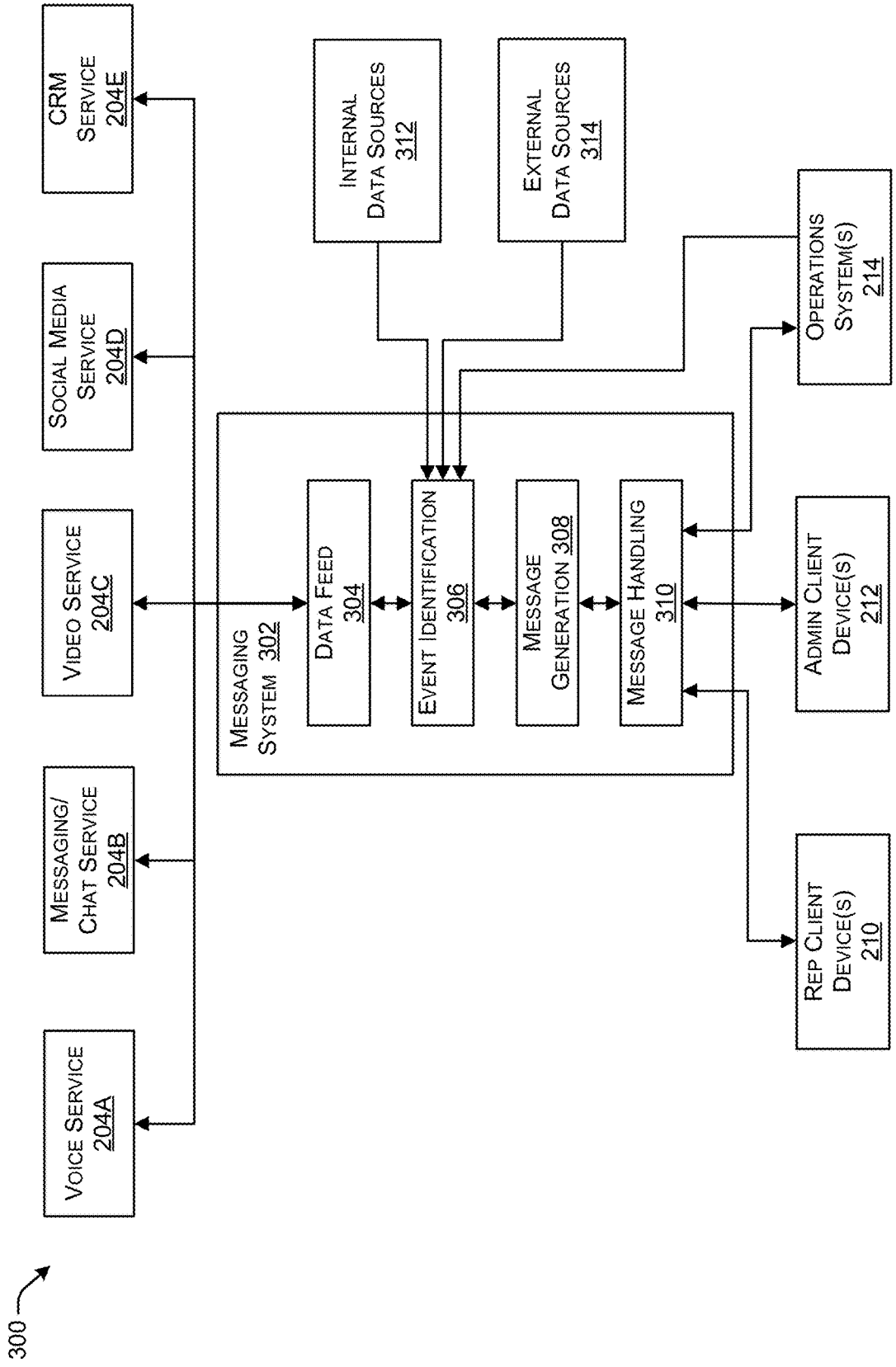
300
VOICE SERVICE 204A
MESSAGING/ CHAT SERVICE 204B
VIDEO SERVICE 204C
SOCIAL MEDIA SERVICE 204D
CRM SERVICE 204E
MESSAGING SYSTEM 302
DATA FEED 304
EVENT IDENTIFICATION 306
MESSAGE GENERATION 308
MESSAGE HANDLING 310
INTERNAL DATA SOURCES 312
EXTERNAL DATA SOURCES 314
OPERATIONS SYSTEM(S) 214
ADMIN CLIENT DEVICE(S) 212
REP CLIENT DEVICE(S) 210

FIG. 3

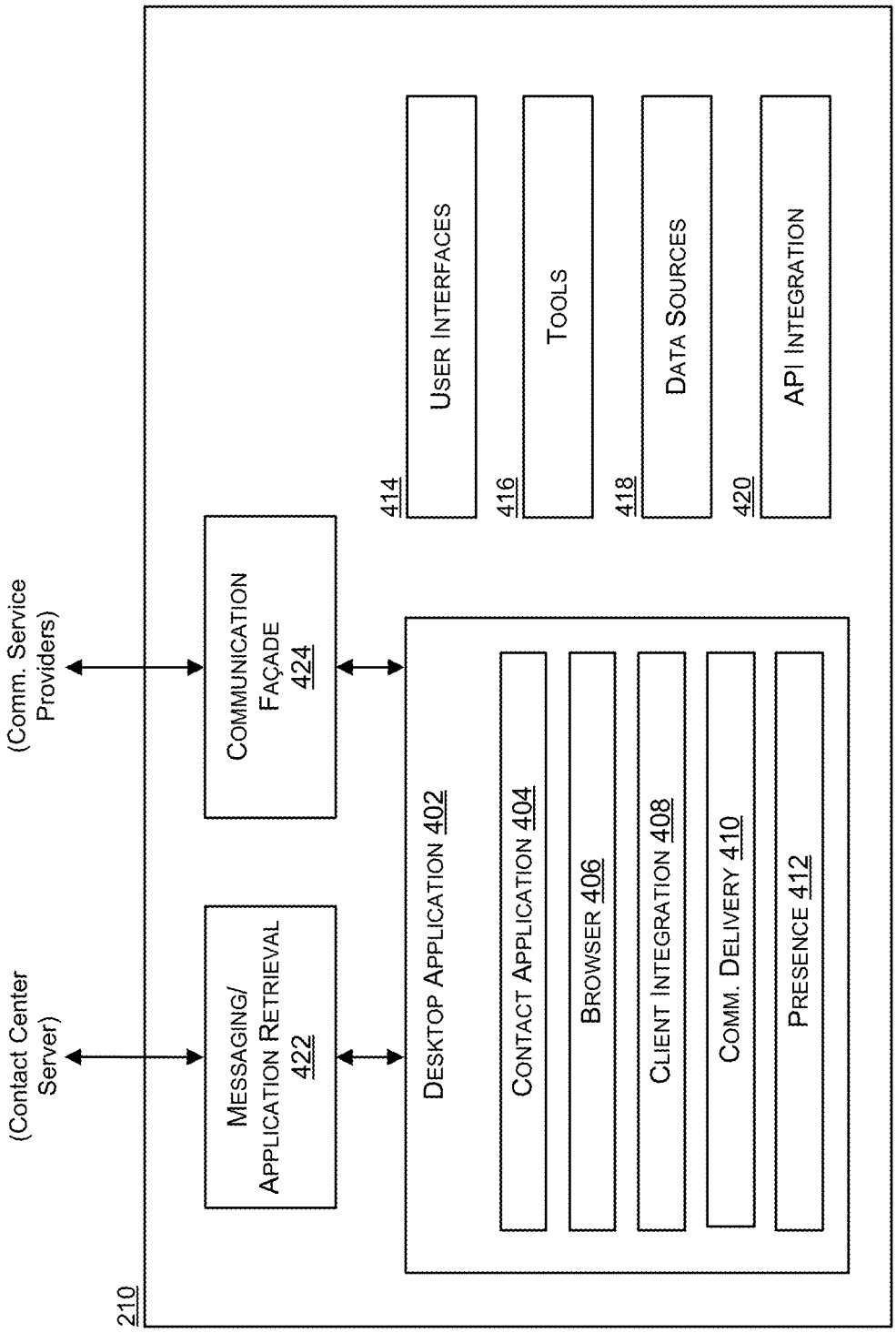
210
(Contact Center Server)
(Comm. Service Providers)
MESSAGING/ APPLICATION RETRIEVAL 422
COMMUNICATION FAÇADE 424
DESKTOP APPLICATION 402
CONTACT APPLICATION 404
BROWSER 406
CLIENT INTEGRATION 408
COMM. DELIVERY 410
PRESENCE 412
414
USER INTERFACES
416
TOOLS
418
DATA SOURCES
420
API INTEGRATION

FIG. 4

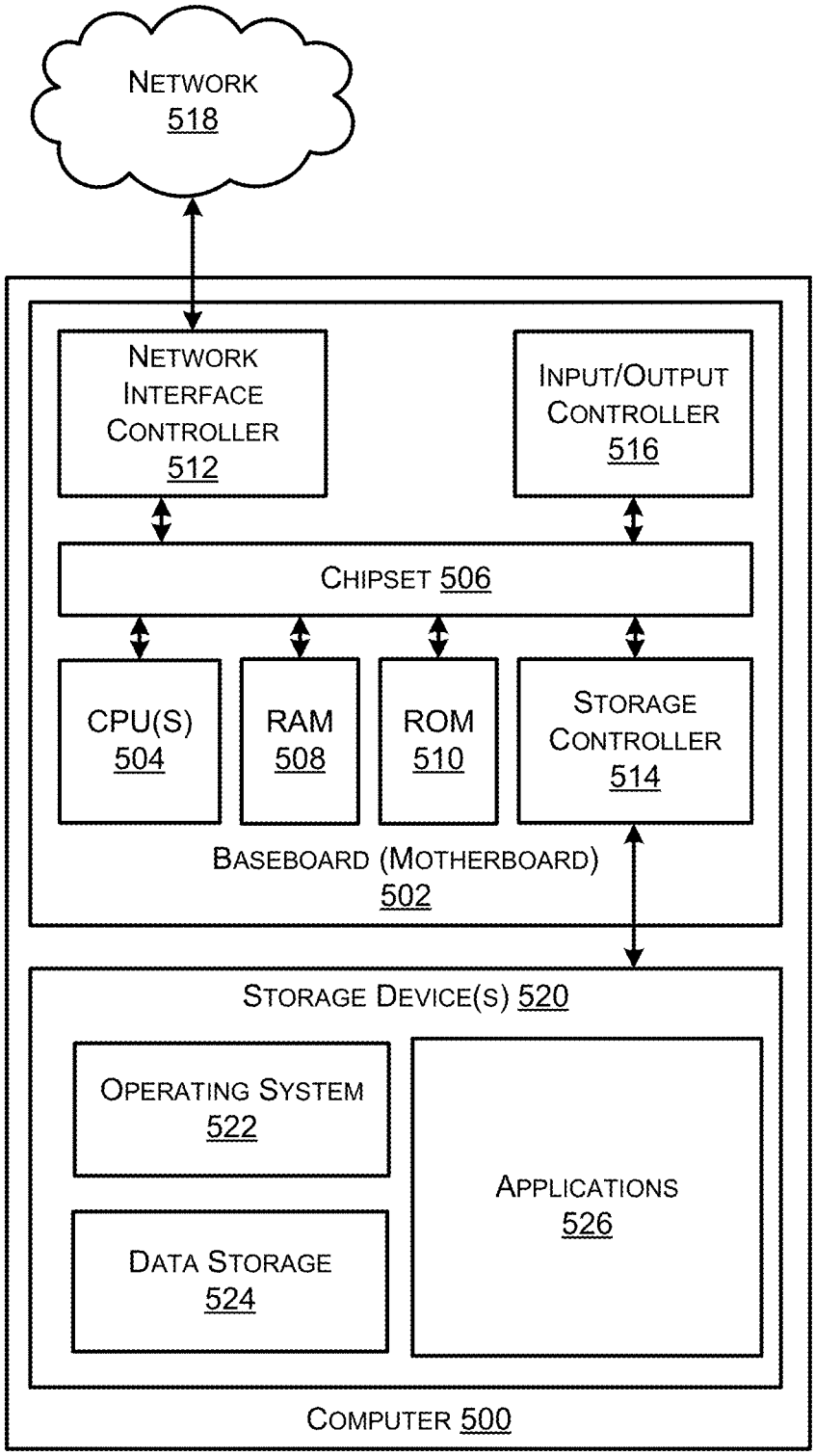
NETWORK
518
NETWORK INTERFACE CONTROLLER
512
INPUT/OUTPUT CONTROLLER
516
CHIPSET 506
CPU(S)
504
RAM
508
ROM
510
STORAGE CONTROLLER
514
BASEBOARD (MOTHERBOARD)
502
STORAGE DEVICE(S) 520
OPERATING SYSTEM
522
DATA STORAGE
524
APPLICATIONS
526
COMPUTER 500

FIG. 5

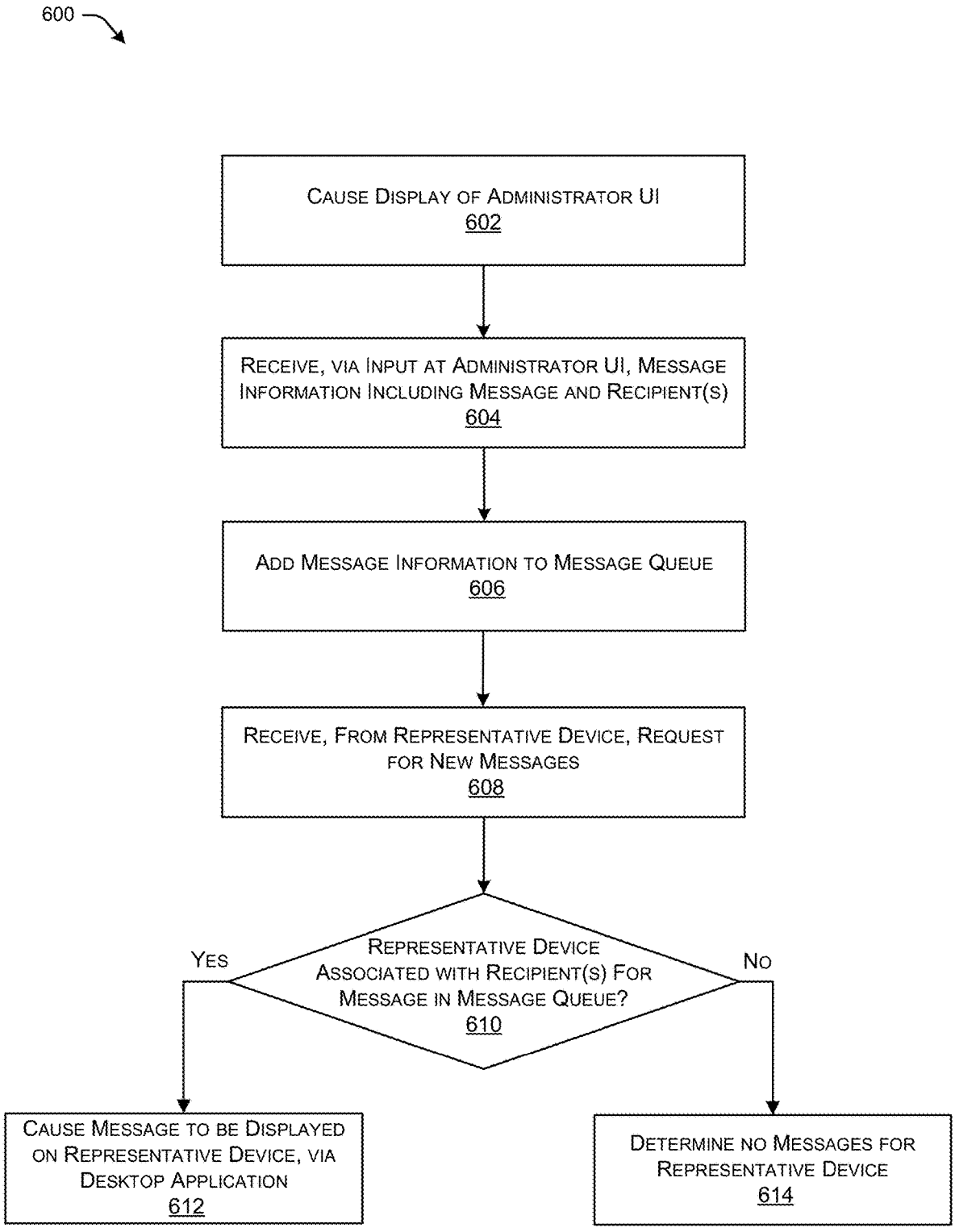
600
Cause Display of Administrator UI
602
Receive, via Input at Administrator UI, Message Information Including Message and Recipient(s)
604
Add Message Information to Message Queue
606
Receive, From Representative Device, Request for New Messages
608
Representative Device Associated with Recipient(s) For Message in Message Queue?
610
Yes
No
Cause Message to be Displayed on Representative Device, via Desktop Application
612
Determine no Messages for Representative Device
614

FIG. 6

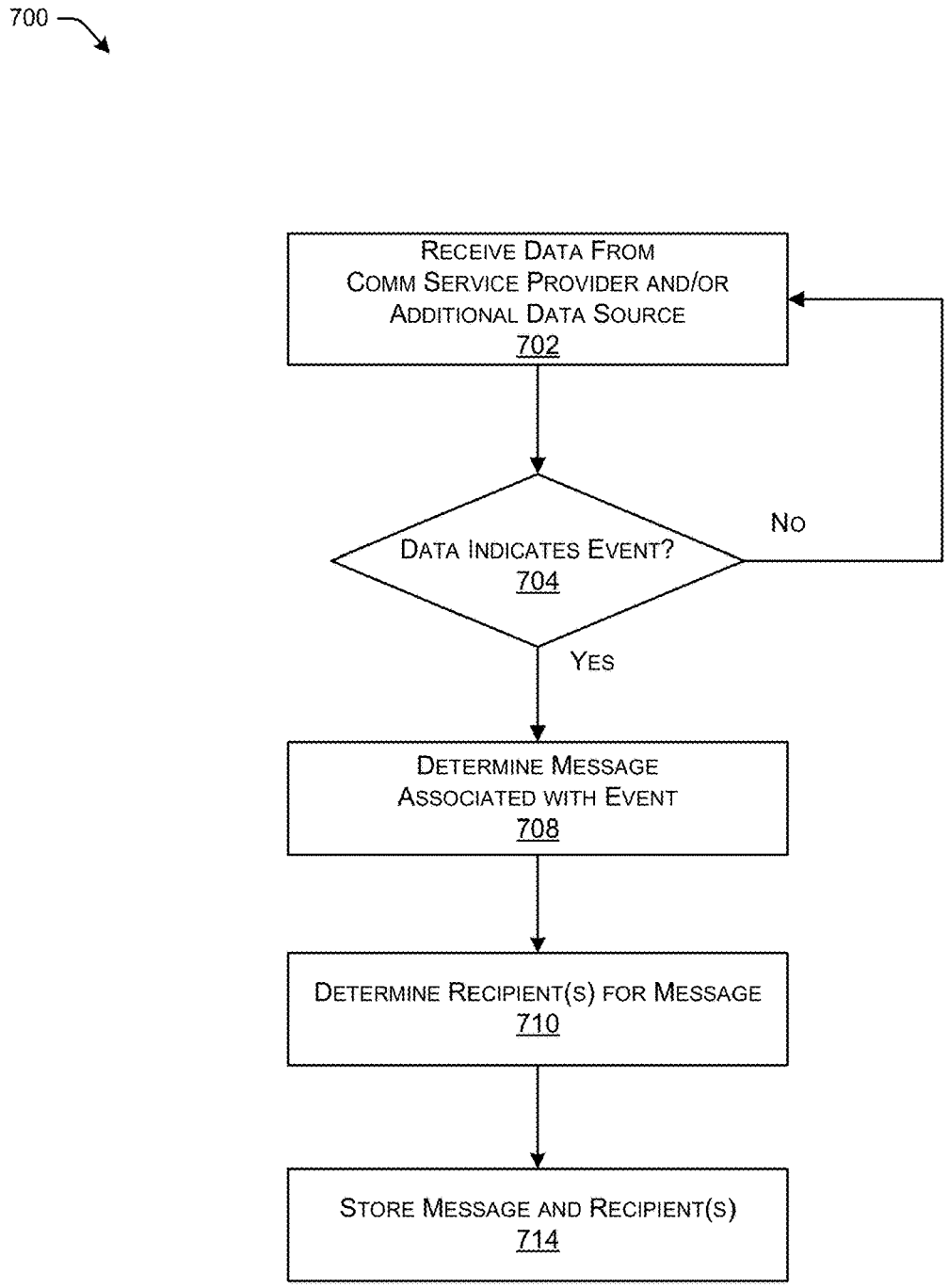
700
RECEIVE DATA FROM COMM SERVICE PROVIDER AND/OR ADDITIONAL DATA SOURCE
702
DATA INDICATES EVENT?
704
NO
YES
DETERMINE MESSAGE ASSOCIATED WITH EVENT
708
DETERMINE RECIPIENT(S) FOR MESSAGE
710
STORE MESSAGE AND RECIPIENT(S)
714

FIG. 7

CONTACT CENTER MESSAGING

RELATED APPLICATIONS

This application is a continuation of and claims priority to U.S. patent application Ser. No. 17/378,204, filed on Jul. 16, 2021, and entitled, "Contact Center Messaging," which claims the benefit of U.S. Provisional Patent Application No. 63/052,773, filed Jul. 16, 2020, and entitled "Contact Center Messaging," the disclosures of which are hereby incorporated herein by reference in their entireties.

BACKGROUND

Large organizations often use automated contact centers to handle interactions between employees or representatives of the organization and customers or other parties. Different types of organizations, including businesses, government agencies, and educational institutions may use automated contact centers for sales, customer service, technical and software support, problem resolution, or the like. Automated contact centers may be small or large-scale, depending on the amount of customer traffic and the structure of the organization. Large-scale contact centers, for example, may include representatives in different roles and/or different departments, using client systems that are distributed across different data centers, geographic locations, and/or networks. In some cases, a customer call or other contact (e.g., video or chat session) into the contact center may be answered first by an automated computer system which requests a series of inputs from the customer to determine where the contact is to be routed.

The various hardware, network, and software components of a contact center may connect and support interactive media sessions between customers and organization representatives, each working independently on the separate computing devices. The contact center also may support transferring customer interaction sessions to different representatives, multi-party interactive sessions, interactions between organization representatives and administrators, etc. Different combinations of interactive session types and/or media types are supported by various contact centers, such as voice sessions (e.g., telephony-based), video chat sessions, email communications, social media-based sessions, etc. Certain contact centers also may use software-based queuing and routing techniques to connect specific customers with specific representatives based on characteristics and criteria such as the purpose of the customer contact, the session/media type, geographic location, language, representative qualifications and certifications, etc.

Because contact centers may be distributed geographically, may support multiple interactive session types and/or media types, and may be used for multiple purposes, coordinating representatives, e.g., by distributing information to those representatives, is often difficult. Conventionally, an administrator desiring to distribute information will compose and send a message in a specific messaging application, e.g., an e-mail or instant messaging app. The recipient(s) of the message will receive the message only if he/she is running, e.g., logged into, the messaging application and/or is actively checking for new messages. However, representatives accessing the contact center may be using specific (and disparate) applications to interact with different types of customers. Separate messaging applications may be confusing and/or detract from assisting customers, and thus often go ignored for long stretches and/or are entirely unused. Accordingly, there is a need in the art for an improved messaging system within contact center environments.

SUMMARY

To address problems and inefficiencies associated with automated contact centers, this disclosure describes various systems and techniques for transmitting or broadcasting messages. In some examples, a thick client framework may include a desktop application via which client devices access containerized application images for interacting with customers. Aspects of this disclosure include displaying messages via the desktop application, e.g., instead of via a separate messaging application. Accordingly, important information can be presented to representatives regardless of the tasks they are performing, application they are running, or the like. In some examples, the framework can generate an administrator interface via which messages can be composed and/or selected for distribution and via which message recipients may be identified. Also in examples, messages may be generated automatically, e.g., using a trained model, in response to the occurrence of one or more events. The framework may also facilitate queuing messages for subsequent retrieval by and/or broadcasting to intended recipients, e.g., for display on a desktop of display devices associated with thick clients. Because messages are presented on the desktop, they may be visible at the client regardless of other tasks performed by the representative and without the representative accessing and/or monitoring a separate messaging application.

In an example of the present disclosure, an example contact center server, includes one or more processors; and one or more non-transitory computer-readable media storing computer-executable instructions that, when executed, cause the one or more processors to perform operations including: hosting, at the contact center server, a desktop application and a plurality of containerized applications for interacting with customers; maintaining, at the contact center server, a message queue; receiving message information associated with a generated message for distribution to one or more recipients; updating the message queue to include the generated message and an identification of the one or more recipients; receiving, from a thick client device, a request for new messages, the thick client device running the desktop application and a containerized application of the plurality of containerized applications; determining that the thick client device is associated with a recipient of the one or more recipients; and causing the generated message to be displayed, via the desktop application, on a display of the thick client device.

In another example of the present disclosure, an example method includes hosting a desktop application and a plurality of containerized applications for interacting with customers; receiving message information associated with a generated message for distribution to one or more recipients; updating a message queue to include the generated message and an identification of the one or more recipients; receiving, from a thick client device running the desktop application and a containerized application of the plurality of containerized applications, a request for messages; determining that the thick client device is associated with a recipient of the one or more recipients; and causing the generated message to be displayed, via the desktop application, on a display of the thick client device.

In yet another example of the present disclosure, one or more example non-transitory computer-readable media stor-

ing instructions that, when executed by one or more processors, cause the one or more processors to perform actions including: receiving information associated with a generated message for distribution to one or more recipients; updating a message queue to include the generated message and an identification of the one or more recipients; receiving, from a thick client device running the desktop application and a containerized application of the plurality of containerized applications, a request for messages; determining that the thick client device is associated with a recipient of the one or more recipients; and causing the generated message to be displayed, via the desktop application, on a display of the thick client device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic illustration of a computing environment associated with an automated contact center and illustrates an example of message generation and distribution, in accordance with one or more examples of the present disclosure.

FIG. **2** illustrates a computing environment associated with an automated contact center, including various internal and external computer systems, services, and user devices, in accordance with one or more examples of the present disclosure.

FIG. **3** illustrates an example of a client software framework for a representative client device, in accordance with one or more examples of the present disclosure.

FIG. **4** illustrates an example of a client software framework for an administrator client device, in accordance with one or more examples of the present disclosure.

FIG. **5** is an example architecture for a computing device capable of executing program components for implementing various techniques described herein.

FIG. **6** is a flow diagram illustrating an example process performed by a contact center, in accordance with one or more examples of the present disclosure.

FIG. **7** is a flow diagram illustrating an example process for generating messages in a contact center, in accordance with one or more examples of the present disclosure.

DETAILED DESCRIPTION

FIG. **1** illustrates an example of transmitting messages in an environment **100** according to aspects of this disclosure. For instance, the environment **100** may schematically represent aspects of a contact center such as a business- or enterprise-wide contact center configured to accept, route, and dispose of customer inquiries. As illustrated in more detail in FIG. **1**, the environment **100** includes a contact center server **102** in communication with each of an administrator device **104**, a first representative device **106(1)**, a second representative device **106(2)**, and a third representative device **106(3)**. Herein, the first representative device **106(1)**, the second representative device **106(2)**, and the third representative device **106(3)**, as well as other representative devices not illustrated, may be referred to as the representative devices **106**. Although FIG. **1** illustrates only a single administrator device **104** and the three representative devices **106**, this is for example only. In some implementations, the environment **100** can include up to and including thousands of representative devices and/or administrative devices.

In the example of FIG. **1**, an administrator or other user interfacing with the administrator device **104** generates or selects messages for distribution to one or more of the representative devices **106**. Specifically, the administrator device **104** may include or otherwise access a message generation component **108** and a message transmission component **110**, as detailed further herein.

The administrator device **104** may implement the message generation component **108** to open or otherwise access a message generation user interface **112**. For instance, the administrator device **104** may render the message generation user interface **112** on a display of the administrator device **104**. As illustrated in FIG. **1**, the message generation user interface **112** can include a message window **114** and a recipient window **116**, among other features. As illustrated, the message window **114** can include one or more messages **118**, shown as textual messages in FIG. **1**. For instance, the messages **118** shown in FIG. **1** are "Hail Storm in Chicago, IL," "Call Center X Closed," and "Application Y unavailable-follow procedure Z." Of course, the messages **118** illustrated are for example only. In the illustrated embodiment, the message window **114** includes the messages **118** as a list of pre-generated messages. For instance, the messages **118** may be messages previously generated by the administrator logged into or otherwise using the administrator device. In other examples, the messages **118** may include messages generated by other administrators, by other administrator devices, and/or otherwise generated. As detailed further herein, and particularly with reference to FIG. **3**, the messages **118** may include messages generated by a machine learned model or other computer-implemented process. Although the message window **114** is illustrated as presenting the messages **118** as a list, the message window **114** may be otherwise arranged. Moreover, the message window **114** may include additional functionality, such as for searching, filtering, or otherwise identifying pre-generated messages. Moreover, and although not illustrated in FIG. **1**, the message window **114** may also or alternatively include data entry functionality, such as a text box or similar interface, via which a user of the administrator device **104** may compose a new message.

The recipient window **116** includes one or more recipients **120**. In the illustrated example, individual of the recipients **120** are groups, specifically, "Group A," "Group B," and "Group C." For instance, each of the groups may include a number of individual recipients sharing one or more common characteristics. For example, individual of the groups may be based on a function within an organization, a status within the organization, a geographic location, or the like. Alternatively, the recipients **120** may include individual recipients, e.g., individual people. The recipients **120** are not limited to those illustrated in FIG. **1**. In some example, the recipients window **116** may show most recently contacted recipients, favorite recipients, e.g., designated by an administrator accessing the administrator device **104**, or otherwise. Although not illustrated in FIG. **1**, the recipient window **116** may include additional functionality for identifying recipients. For instance, the recipient window may include search, filtering, and/or other functionality for identifying recipients. Although the message window **114** and the recipient window **116** are referred to herein as a "window," the functionality of the message window **114**, e.g., for selecting and/or generating messages for distribution to recipients, and of the recipient window **116**, e.g., for selecting and/or identifying recipients to receive messages, are not limited implementation via any specific graphic, layout, or other construct. In examples, the recipients can include all recipients within an organization and/or some subset of all recipients, e.g., without a limit to the number.

In operation, an administrator accessing the administrator device **104** desiring to send a message may interact with the message generation user interface **112** by selecting a message from the messages **118** in the message window **114** and a recipient from the recipients **120** in the recipient window **116**. In the example illustrated, the message "call Center X closed" is visually offset relative to other of the messages **118**, indicating that the administrator using the administrator device **104** has selected this message. Similarly, "Group C" is offset relative to other of the recipients **120**, indicating that the administrator using the administrator device **104** intends to send the selected message to this group of recipients. In examples, the administrator can select the message and the recipient(s) using conventional user interface tools, including but not limited to, a touch screen, a mouse, a keyboard, a stylus, or the like. The message generation user interface **112** also includes a user interface element **122**, labelled "send" in the example. Selection of the "send" user interface element **122** may cause the "call center X closed" message to be sent to the "Group C" recipients, as described herein.

In some examples, in response to a user selecting the user interface element **122**, the message transmission component **110** of the administrator device **104** can generate message information **124** comprising information indicative of and/or associated with the selected message and/or information indicative of and/or associated with the recipients. The message transmission component **110** can generate one or more of a file, a packet, and/or other data structure(s) to embody the message information **124**. Moreover, the message transmission component **110** can send the message information **124** to the contact center server **102**, e.g., for distribution to the intended recipients, as described further herein.

As illustrated in FIG. **1**, the message information **124** may be received at the contact center server **102**. For instance, the contact center server **102** includes a messaging component **126** that receives the message information **124**. In more detail, the messaging component **126** includes functionality to generate and/or maintain a message queue **128**. A visualization of the message queue **128** is provided in FIG. **1**, and includes two messages **130**, e.g., "Call Center X Closed" and "Wildfires in San Jose, CA." The first message, "Call Center X Closed," corresponds to the message generated at and received from the administrator device **104**. The second message, "Wildfires in San Jose, CA," may also be generated at and/or received from the administrator device **104**. In other instances, the second message can be received from a different administrator device associated with the environment **100**, from a machine-learned model (as detailed further herein), and/or from some other source.

Although the visualization of the message queue **128** shows only text associated with messages contained therein, the message queue **128** and/or the messaging component **126** also stores additional data associated with the message information **124**. For example, the messaging component **126** stores or causes to be stored recipient information association with the messages, e.g., as identifiers of users or groups of users who are to receive the various messages. In examples, the contact center server **102**, e.g., via the messaging component **126**, can store associations of users with groups of users. Additional data associated with the message queue **128** can include time information. By way of non-limiting example, messages in the message queue **128** can have an associated duration, e.g., a length of time for which the message is to remain in the message queue **128**. Although not illustrated in FIG. **1**, an administrator can identify a duration for which a message is to last via the message generation user interface **112**.

As also illustrated in FIG. **1**, the contact center server **102** hosts a desktop application **132** and a plurality of contact applications **134**. As detailed further herein, a contact center implementing the contact center server **102** may provide a centralized hub or software architecture for many diverse segments of a business or organization. That is, the contact center server **102** may host a number of different applications accessible by administrators, e.g., via the administrator device **104**, by representatives, e.g., via the representative devices **106**, and by customers (not shown in FIG. **1**). The contact center may have an overarching framework, embodied at least in part in the desktop application **132**. In some examples, aspects of the desktop application **132** may be accessed by the representative devices **106** to access all other applications, including the contact applications **134**. In other examples, the desktop application **132** may be at least partially stored on the administrator device **104** and/or the representative devices **106**.

The contact applications **134** are applications accessed and used by the representative devices **106**. As detailed further herein, the representative devices **106** can be thick client devices that access the contact applications **134** and/or download an instance of the contact applications **134** to perform actions associated with the contact center server. In some examples, the contact applications **134** may be containerized applications accessible via images maintained at the contact center server **102**. The contact applications **134** are run, e.g., by receiving, unpacking, execution, on the individual representative devices **106** to perform contact-related services. In some instances, the contact applications **134** are third-party software applications that facilitate one or more specific contact interactions. For instance, a first of the contact applications **134** may allow a representative using one of the representative devices **106** to have a text-based conversation with a customer accessing the contact center via a "chat" function, e.g., available on a web site or application. A second of the contact applications **134** may allow a representative using one of the representative devices **106** to have a voice-based conversation with a customer accessing the contact center server **102**, e.g., via a phone or other speech-based interface.

Techniques including using containerized application images as the contact application **134** may improve the functioning the contact center environment **100** by providing applications (or sub-processes therein) that are device specific and/or user specific to client devices, such as the administrator device **104** and/or the representative devices **106**. Additional technical advantages of such features within contact center environments may result from more efficient and streamlined software updates and modifications. For instance, when an organization is required to modify or reconfigure a thick client application, if the thick client application is installed on each separate client device then a software update or patch may be transmitted to all client devices associated with the contact center. These decentralized software updates may be uncoordinated, unreliable, and inefficient. In contrast, distributing containerized application images from a repository stored in the contact center server **102** of the contact center may improve performance and distribution of software updates within the contact center.

The representative devices **106** run instances of the desktop application **132**. For instance, the desktop application **132** may be run on each of the representative devices **106** upon a representative logging into the representative devices **106**. The representative devices **106** also run instances of the

contact applications **134**. For instance, FIG. **1** illustrates a first user interface associated with the first representative device **106** (**1**), a second user interface **136** (**2**) associated with the second representative device **106** (**2**), and a third user interface **136** (**3**) associated with the representative device **106** (**3**). The first user interface **136** (**1**), the second user interface **136** (**2**), and the third user interface **136** (**3**) may be referred to collectively as the user interfaces **136**. In implementations, the user interfaces **136** are substantially the same across each of the representative devices **106**. For instance, each of the user interfaces **136** may provide similar functionality, including functionality to access and/or launch one or more of the contact applications **134**. As illustrated, the first user interface **136** (**1**) includes an instance of an "Application A," the second user interface **136** (**2**) includes a second instance of the "Application A," and the third user interface **136** (**3**) includes an instance of a different "Application B." As will be appreciated, the "Application A" and the "Application B" are examples of the contact applications **134**.

In addition to facilitating access to applications including the contact applications **134**, the desktop application **132** provides additional functionality. Specifically, the desktop application, in conjunction with other aspects of the contact center server **102**, facilitates messaging functionality, as described herein. More specifically, via the desktop application hosted by the contact center server **102**, the individual representative devices **106** may query the contact center server **102** for messages. In examples, the representative devices **106** may send queries automatically, e.g., at predetermined times. Without limitation, the representative devices may query the contact center server **102** for messages upon a representative logging into the desktop application **132**, according to a predetermined frequency, in response to certain actions being performed, and/or at other times. In response to a query sent by one of the representative devices **106**, the contact center server **102**, e.g. the messaging component **126** of the contact center server **102**, may determine whether any of the messages **130** in the message queue **128** are intended for the representative device sending the query. In the example illustrated in FIG. **1**, the contact center server **102** may determine whether one of the representative devices **106** sending the query is associated with one of the users in "Group C," and thus should receive the message "Call Center X Closed."

In response to determining that a representative device requesting messages is associated with one or more recipients of one of the messages **130** in the message queue **128**, the contact center server **102**, e.g., using the messaging component **126**, sends message information **138** to the recipient device. In the example of FIG. **1**, the first representative device **106**(**1**), after querying the contact center server **102** for messages, receives the message information **138**. The third representative device **106**(**3**), after querying the contact center server **102** for messages, also receives the message information **138**. The first representative device **106**(**1**) and the third representative device **106**(**3**) receive the message information **138**, because those devices, and/or the users of those devices, are associated with the "Group C." For instance, "Group C" may include devices in a geographic area and the first representative device **106**(**1**) and the third representative device **106**(**3**) may be located in that geographic area. Alternatively, "Group C" may include specific users, and the users logged into the desktop application **132** running on the first representative device **106**(**1**) and on the third representative devices **106**(**3**) are associated with Group C in this example. As will be appreciated, the second representative device **106**(**2**) also queries the contact center server **102**, but the contact center server **102** determines that the second representative device **106** (**2**) should not receive the message information **138**, e.g., because the second representative device **106**(**2**) is not associated with "Group C."

As also illustrated in FIG. **1**, the message information **138** received in each of the first representative device **106** (**1**) and the third representative device **106** (**3**) causes the message to be displayed in a portion of the respective graphical user interface **136**. Specifically, a portion **140** (**1**) of the first graphical user interface **136** (**1**) of the first representative device **106** (**1**) and a portion **140** (**2**) of the third graphical user interface **136** (**3**) associated with the third representative device **106** (**3**) display the text "Call Center X Closed." The portion **140** (**1**) and the portion **140** (**2**) (collectively, "the portions **140**") are for example only, as the message may be displayed anywhere on a display of the appropriate representative devices **106**. In some examples, the portions **140** may represent a banner, a window, or the like. Moreover, the portions **140** may display the message using different graphical mechanisms, including but not limited to scrolling text, flashing text, or the like.

As will be appreciated, according to aspects of this disclosure, messages can be routed from an administrator e.g., operating an administrator device **104** to representatives, e.g., operating the representative devices **106**. Such messages may be displayed directly on the display of the appropriate representative devices **106** without any affirmative action by the representative operating the representative devices **106**. For instance, messages generated at the administrator device **104** can be displayed directly on the representative devices **106** without the need for opening or even installing a messaging application on the representative devices **106**. In conventional contact center environments, messages are received via a special messaging application, and representatives only receive messages when they are the messaging application is open on the device being used by the representative, and only when the representative is actively looking for messages. In contrast, the present disclosure provides a means for providing important information to representatives regardless of the application(s) running on the representative device. As illustrated in FIG. **1**, both the first representative device **106** (**1**) and the second representative device **106** (**2**) are using the same contact application, that is, "Application A," whereas the third representative device **106** (**3**) is using a different contact application, that is, "Application B."

FIG. **2** illustrates an example computing environment associated with a contact center **200**. The contact center **200** may be, or may include, the contact center server **202** for implementing novel message distribution, as detailed herein. Contact centers described herein, including the contact center server **202** and/or the contact center **200** may include fully automated and/or semi-automated contact center environments. In this example, dotted box **202** identifies the internal components of the contact center **200**, and components outside the dotted box **202** represent external components associated with the contact center. As used herein, an internal component of a contact center may refer to a component (e.g., computer server or device, network component, software service, application, etc.) that is controlled by the organization operating the contact center. In contrast, an external component of the contact center may refer to a component that interacts with at least one internal component of the contact center, but which is not controlled by the organization operating the contact center. As shown in this

example, the external components associated with the contact center may include a number of external communication services **204**A-**204**E (collectively "services **204**") and/or tools **205** which may be provided by third-party service providers. Additional external components may include communication network(s) **206** and one or more customer devices **208** that communicate in interactive sessions with representatives (e.g., employees, contract workers, etc.) of the organization.

In some implementations, the internal components of the contact center may reside within a single server, e.g., the contact center server **102**, and/or single data center operating at one geographic location. In such cases, some or all of the internal components of the contact center **200** may communicate via a secure private network such as a private LAN or secure corporate network protected by a firewall. In other implementations, the internal components may be distributed across multiple servers and/or multiple data centers that operate at different geographic locations. Internal components that are distributed across data centers may communicate via secure private networks and/or via unsecure public networks (e.g., the Internet) and may use tunneling and encryption technologies. As illustrated, the internal and external components of the contact center may communicate via communication networks **206**, including but not limited to computer networks (e.g., TCP/IP networks, etc.), wireless networks (e.g., Long-Term Evolution (LTE), 5G, a Universal Mobile Telecommunications Service (UMTS), Global System for Mobile communications (GSM) networks, etc.), satellite networks, and the like.

In operation, the contact center **200** may be implemented via the computing environment shown in FIG. **2** to provide interactive communication sessions (or interactive sessions) between customers using the customer devices **208**, and representatives of the organization using representative client devices **210** ("client devices **210**"). The customer device (s) **208** and/or the representative client device(s) **210** may be any personal computing devices, such as desktop or laptop computers, mobile devices (e.g., smartphones, tablet computers, etc.), wearable computing devices, or any other device capable of communicating over the communication network(s) **206**. In some scenarios, a customer, client, or other individual associated with the organization may use the customer device(s) **208** to contact the organization via a point-of-contact service, such as web portal(s) **220** or a voice gateway **222**. In some examples, the contact center **200** may support different services for different communication types, such as the web portal **220** that processes web chat requests received via the web site of the organization, the voice gateway **222** that processes calls received via a telephone network and/or Voice over IP (VOIP) calls. Although two customer portals/gateways into the contact center **200** are shown in this example, any number of additional customer portals/gateways may be used in other implementations, such as portals or gateway services for voice communications from the customer device(s) **208**, video communications, messaging/chat communications, social-media based communications, customer relationship management (CRM) based communications, or the like.

After one of the customer device(s) **208** initiates communication with the contact center, or vice versa, the contact center components may assign the customer to a representative and initiate an interactive session between the customer device **208** and one of the representative client device(s) **210**, e.g., associated with the assigned representative. Interactive sessions may include voice sessions, video sessions, messaging/web chat sessions, social media sessions, and/or CRM sessions, etc. As shown in this example, the contact center **200** may use external services **203** to implement the functionality of providing interactive sessions between customers and representatives. For instance, the contact center **200** in this example uses a voice service **204**A from a first external service provider, a messaging/chat service **204**B from a second external service provider, a video service **204**C from a third external service provider, a social media service **204**D from a fourth external service provider, and so on. In various examples, the contact center **200** may use any combination of external or internal communication services.

The external services **203** may include communication services to implement interactive sessions between a customer and a contact center representative, as well as additional services/tools to support additional features and functionalities of the contact center. For instance, one or more third-party tools **205** may be provided via external service providers and accessed by the internal systems of the contact center **200**. Such third-party tools **205** may include, by way of illustration only, transcript generation and/or analysis tools, customer sentiment analysis tools, sales script tools, contact monitoring tools, data analytics tools, workforce management tools, post-interactive session survey tools, etc. As with the communication services **204**A-**204**E, the third-party tools **205** are depicted in this example as external components of the contact center, but some or all of these tools may be implemented as internal components within the contact center.

As shown in FIG. **2**, a customer may initiate communication via a web portal **220** or voice gateway **222**, after which the contact center components select a communication service **204**A-**204**E based on the communication type used by the customer, and an interactive session is initiated between the customer device **208** and representative client device **210**. Although in this example the customer devices **208** are depicted as initiating communication sessions by first contacting an internal component of the contact center (e.g., web portal **220** or voice gateway **222**), in other examples the customer devices **208** may initially contact an external communication service **204**A-**204**E. For example, customer service links on the organization's web site may be hosted by and/or redirected to the external services **203**. In some cases, the customer communication into the contact center may be answered first by an automated computer system (e.g., implemented within an external service or an operations system **214**), which requests a series of inputs from the customer. Such automated systems may be implemented as voice response units for voice calls, conversation bots for web chat sessions, etc. The inputs requested from the customer via an automated system may include data identifying the customer (e.g., customer name, account number, ticket number, etc.), the purpose of the contact (e.g., a question type, a product model, etc.), or the language or geographic region of the customer, and the like. Based on the customer's responses, the automated system may determine where to direct the customer for an interactive session, for instance, to a particular data center, department of the organization, a representative having a particular role, criteria, or credentials, or to a particular representative that has had previous contact with the customer.

In some examples, certain internal components of the contact center may be used to select a communication service provider **204** and initiate a communication session between a customer device **208** and a client device **210**, after which the internal components may extricate themselves from the process and allow the selected communication

service provider **204** to manage the session. For example, as described below, operations systems **214** and internal computer servers and/or components within the integration layer **216** may receive and analyze data associated with incoming requests for interactive sessions from customer devices **208**, and assign the interactive sessions to services **204** and client devices **210** to perform the interactive session. The operations systems **214** and integration layer **216** also may receive and handle requests to transfer contacts from one representative to another, initiate multi-party interactive sessions, and initiate communication sessions between client devices **210** and administrator client devices **212** or entities within the contact center environment. The various operations systems **214** and components within the integration layer **216** also may monitor and analyze the interactive sessions to determine performance metrics for representatives and the contact center as a whole, and to implement policies and instructions based on various models (e.g., contact quality models, efficiency models, workflow projection models, etc.).

The integration layer **216** may provide a common interface between the internal systems and components of the contact center and the external services **203** used by the contact center. For example, representative client devices **210** may communicate with the external communication services **204**A-**204**E and third-party tools **205** via the components within the integration layer **216**. In some cases, the integration layer **216** provides a common framework for interfacing with the external services **203**, so client applications executing on representative client devices **210** may perform similar or identical operations regardless of which external service provider is used. In such examples, the integration layer **216** may therefore provide technical advantages and improve the functioning of the contact center components by providing support for plug-and-play among the external communication services **204** and/or the third-party tools, without requiring any software change within the client applications executing on the representative client devices **210**, the administrator client devices **212**, and/or the customer device(s) **208**.

For instance, a voice service **204**A provided by a third-party vendor for a contact center may be replaced by a different voice service **204**A provided by a different third-party vendor, without requiring any functional change to the client applications executing within the representative client devices **210** and/or the administrator client devices **212**. Similarly, the integration layer **216** may interface with multiple different external services **203** for a single communication type (e.g., multiple different voice services **204**A, multiple different messaging/chat services **204**B, etc.) simultaneously, so the contact center can use multiple external services **203** for a single communication type at the same time, in a manner that is transparent with respect to the external services **203**, the representative client devices **210**, and/or the administrator client devices **212**. In such cases, an external communication service **204** may operate similarly or identically regardless of whether the contact center is using another service provider to provide an alternative communication service. The representative client devices **210** and/or the administrator client devices **212** also may operate similarly or identically regardless of which of the external services **203** (or the internal services in the dotted box **202**) is providing an interactive session for the representative client device **210**.

The integration layer **216** also may provide an interface between internal components of the contact center (e.g., the representative client devices **210**, the administrator client devices **212**, the operations systems **214**) and third-party tools **205** which operate as services or applications external to the contact center **200**. For instance, the internal operations systems **214** of the contact center may access third-party tools **205**, such as data analytics tools, workforce management tools, etc., via the integration layer **216**. The representative client devices **210** also may access the third-party tools **205** via the integration layer **216** during an interactive session between a representative and customer. The third-party tools **205** can include customer sentiment tools, post-interactive session survey tools, or the like. As noted above, the integration layer **216** may provide a uniform and common interface for accessing external third-party tools **205**, so that various third-party tools **205** may be added, removed, replaced, or upgraded, without requiring any changes to the application software of the contact center internal components.

Additionally, the integration layer **216** may provide an interface between various internal components of the contact center. For example, the representative client devices **210** may communicate via the integration layer **216** with other of the representative client devices **210**, with the administrator client devices **212** and/or with other internal servers/systems of the contact center **200**. For instance, the integration layer **216** may perform operations associated with sending and receiving messages within the contact center **200**. For instance, and with reference to FIG. **1**, the integration layer **216** may manage and/or have access to the message queue **128**, may receive the message information **124** from the administrator device **104**, and/or may cause the messages **118** to be displayed at the first representative device **106**(**1**) and the third representative device **106**(**3**). Moreover, the operations system(s) **214** may be implemented within internal computer servers of the contact center, and may provide functionalities for common queuing, monitoring, and analysis and modeling, and policy implementations across the contact center. As described below, client devices **210** may communicate with various operations system(s) **214** via the integration layer **216**, allowing the operations system(s) **214** to receive data regarding the interactive sessions executed on the client devices **210**, analyze and/or model the data, and determine operational instructions for the client devices **210** to implement operational models (e.g., rules and/or policies) across the contact center. Such models may include quality control models, workforce management models, contact center efficiency models, etc.

As illustrated by these examples and the other examples described herein, the integration layer **216** may provide additional technical advantages within contact center environments, including improving the functioning and efficiency of client devices **210** and other internal operational systems **214**. For instance, the integration layer **216** may provide a common queuing framework for client devices **210**, which is capable of managing the work queue(s) for the client devices **210** (e.g., live customer contact queues, deferred work item queues, etc.) received from various external and internal contact center services. As noted above, the integration layer **216** also may provide internal operational systems **214** with detailed data regarding interactive sessions from diverse client devices **210** in a consistent and uniform manner, allowing the operational systems **214** to improve the performance, contact quality, and workflow across the contact center. Operational systems **214** also may include rules engines using heuristics and/or trained machine-learned models to analyze the interactive session data received from different client devices **210**, and may

transmit instructions and/or policies to client devices **210** across the contact center to implement uniform and consistent models.

The integration layer **216** is depicted in FIG. **2** as a separate internal component of the contact center. In such examples, the integration layer **216** may include one or more dedicated computer servers and/or software applications or services configured to perform the functionalities of the integration layer **216** described herein. In other examples, the integration layer **216** depicted in FIG. **2** may represent a conceptual layer, in which some or all of the components and functionalities of the integration layer **216** may be implemented within other internal or external devices and systems. For instance, any or all portions of the integration layer **216** may be implemented within the external communication services **204** and/or other external services provided by third-party vendors. Additionally or alternatively, some or all of the integration layer **216** may be implemented within the client devices **210**, administrator client devices **212**, and/or operations systems **214** within the contact center. For example, the client devices **210** may run a desktop application and/or communication façade(s) to initiate and manage communications with external services **204** and other internal components/systems. These applications, façades, and other services or interfaces of the client devices **210** and/or other operations systems **214** of the contact center may implement various portions of the integration layer **216**.

FIG. **3** illustrates a computing architecture **300** including a messaging system **302** with various components for receiving, generating, and/or transmitting messages. For example, the computing architecture **300** may be a portion of a contact center environment, such as the contact center server **102** and/or the contact center **200**. In this example, the messaging system **302** includes a data feed component **304**, an event identification component **306**, a message generation component **308**, and a message handling component **310**. As detailed further below, the various components of the messaging system **302** may receive, store, and use data from various different sources, including data relating to live contacts handled by the contact center **200**. A live contact may refer to an ongoing communication session between one of the customer device(s) **208** and the various components of the contact center **200**, including customer-requested sessions that are in-queue and awaiting assignment, on-hold, as well as active interactive communication sessions between the customer device(s) **208** and one of the representative client device **210**.

In various examples, the messaging system **302** may be implemented as a single computing device or server, or as a combination of multiple interconnected devices and/or servers, e.g., within the integration layer **216** of the contact center **200**. As such, the messaging system **302** and associated software components, e.g., one or more of the data feed component **304**, the event identification component **306**, the message generation component **308**, and/or the message handling component **310** may include and/or may be executed on hardware-based computing devices or servers having hardware/network infrastructures and components such as processor(s), computer-readable memory, network interface(s), etc. Additionally or alternatively, some or all portions of the messaging system **302** and/or its associated components described herein may be implemented within other systems internal or external to the contact center **200**, such as within representative client devices **210**, administrator client devices **212**, and/or within the operations system(s) **214** of the contact center **200**.

A contact center **200** may support a number of different communication session types, which may be initiated, managed, and/or supported by the communication service providers **204**. In various examples, the communication service providers **204** may be external to the contact center **200**. In this example, the messaging system **302** may receive information from the communication service providers **204**A-**204**E to establish network connections and stream media between customer device(s) **208** and the representative client device(s) **210**. When the contact center receives a customer request for an interactive session, the request may be assigned to a particular one of the communication service providers **204** based on the communication media type and/or based on the communication gateway or portal from which the customer accessed the contact center (e.g., voice, video, web chat, social media, etc.). The assignment may also be based on one or more other criteria, including but not limited to a geographic location or region of the customer, current service provider status, current contact center status, or the like. If a qualified representative is immediately available to handle the request, the contact center, using services from the communication service providers **204**, may establish the network connections to initiate and manage the interactive session between the customer device(s) **208** and the representative client device **210** of the available representative. Otherwise, the customer request may be queued during which the customer device(s) **208** may remain connected to the contact center, e.g., a representative is available to handle the contact.

At any time during a live contact with the customer device(s) **208**, including when the contact is in-queue, on-hold, or when the contact is connected to a representative client device **210**, the contact center **200** may generate data relating to the live contact. As shown in this example, the live contact-related data may be transmitted from the service providers **204** to the messaging system **302**, e.g., the data feed component **304**. For instance, the communication service providers **204** may output data indicating a change in the status of the live contact, such as when the contact is first received, queued, connected to one of the representative client devices **210** or one of the administrative client devices **212**, placed on hold, disconnected or terminated, etc. Additionally, the communication service providers **204** may generate and output data based on any user inputs received via the customer device(s) **208** before the customer is connected to a representative, such as the customer's responses to an automated menu or voice response unit (VRU) for voice contacts, or responses to a conversation bot for web chat contacts. The communication service providers **204** also may generate and output status data relating to the network connection and quality (e.g., network types and access networks, network traffic and performance, available bandwidth, etc.) and media quality (e.g., media resolution, latency issues, buffering events, etc.).

The data feed component **304** within the messaging system **302** may receive data from communication service providers **204** relating to the current live contacts (e.g., queued, on-hold, or during an interactive media session) of the contact center **200**. Depending on the size and scale of the contact center **200**, the data feed component **304** may receive data associated with hundreds or even thousands of live contacts concurrently. In some examples, the messaging system **302** may subscribe to receive steams of event data from the communication service providers **204** relating to live contacts for the contact center **200**. Such subscriptions may include push notifications transmitted from the communication service providers **204** to the data feed compo-

nent **304**, where each notification subscription may include events for a single contact, group of contacts, or for all contacts associated with the contact center environment **100**. In some instances, the communication service providers **204** may output event data to cloud-based data stores or other data repositories. In such cases, the data feed component **304** may subscribe to receive event notifications from the cloud data stores/repositories, or may periodically query the cloud data stores/repositories to retrieve the updated event data for any live contacts of the contact center **200**.

The event identification component **306** may receive information from the data feed component **304** and determine events. As used herein, an event may be any condition, occurrence, or circumstance that may affect people or devices associated with the contact center **200**. For instance, an event may affect a segment of customers of the business operating the contact center **200**. In one example, the business operating the contact center **200** may be an insurance provider, and the event may be a weather-related occurrence in a geographic area impacting, or that may impact, policy-holders in that area. In another example, the event may be an event that affects one or more functional components of the contact center **200**. For instance, one of the communication service providers **204** may be experiencing technical difficulties, and the event may be the unavailability of the specific provider. In a still further example, an event may be information that impacts representatives that access the contact center **200** via the representative client devices **210**. For instance, the event may be associated with introducing availability of new training and/or support materials for the representative.

In addition to receiving information from the data feed component **304**, the event identification component **306** is also illustrated as receiving information from internal data sources **312** and external data sources **314**. For instance, information from the internal data sources **312** and/or the external data sources **314** may also or additionally be used to determine an event. By way of example, if the data initially available for a customer request to the contact center includes customer device data (e.g., a customer phone number, device identifier and/or network address), then the event identification component **306** may use the initial customer device data to retrieve additional customer-related data from the internal data sources **312** of the organization, such as the customer's name and account data, previous customer claims data, customer billing data, etc. Additionally, the event identification component **306** may use the data initially available (e.g., customer phone number and/or network address) to retrieve customer-related data from the external data sources **312**, which may include external governmental databases, educational institutions, financial institutions, workplace databases, social media servers, or other third-party data sources. Data from the internal data sources **312** and/or from the external data sources **314** may include customer demographic data (e.g., age, occupation, marital status), geographic data (e.g., the customer's home state, county, or city, and/or the customer's current location), financial/purchase data (e.g., income, recent larges purchases, etc.), or life event data (e.g., recent marriages, divorces, children, etc.).

Data from the internal data sources **312** and/or the external data sources **314** also may be independent of any customer contact with the contact center **200**. For instance, the internal data sources **312** can include information about functioning of the computing systems and components of the contact center **200**. Information from the internal data sources **312** can also include information about updates to aspects of the contact center, including updates to procedures, policies, equipment, functionality, or the like. The external data sources **314** can include third-party information providers. Without limitation, the event identification component **306** can receive weather information, newsfeeds, social media information and/or other information that may be relevant to events. As also illustrated, the event identification component **306** can receive information from the operations system(s). The event identification component **306** can receive any information, from any sources, that may be used to determine an occurrence of an event, as detailed further herein.

As noted above, the event identification component **306** includes functionality to determine events associated with the contact center **200** and/or with individuals associated with the contact center **200**. Generally, the event identification component **306** receives the information from the communication service providers **204**, the internal data sources **312**, the external data sources **314**, the operations system(s) **304**, and/or any other sources and processes this information to determine events. For instance, the event identification component **306** can include a rules engine executing heuristics-based logic to analyze the received data and determine that an event has occurred and/or is likely to occur, based on the data. Additionally or alternatively, the event identification component **306** may include various machine-learned models and algorithms to process the data. Various combinations of machine-learned models and algorithms may be used in different implementations, including but limited to regression algorithms, instance-based algorithms, Bayesian algorithms, decision tree algorithms, clustering algorithms artificial neural network algorithms, and/or deep learning algorithms. The machine-learned models and algorithms within the event identification component **306** may output a predicted or recognized event (e.g., natural disaster, hardware or software malfunction, release of new operating procedures, service interruptions, or other event) and a confidence value or metric associated with such determination.

In one non-limiting example, the data feed component **304** can include voice data from the voice service **204**A, which can include an audio file including voice inputs received from several of the customer device(s) **208**. In this example, the contact center **200** is associated with an insurance provider. The event identification component **306** may perform speech-recognition on the audio files to determine that some number (e.g., a threshold number) of customers have used the term "flood" while interacting with the call center **200** using the voice service **204**A. Based on these uses of the term "flood," the event identification component **306** may determine that some number of customers are experiencing flooding. Also in this example, e.g., using the internal data sources **312**, the event identification component **306** can determine that the customers using the term "flood," are located proximate each other, e.g., in a similar geographic area. Moreover, using the external data sources **314**, the event identification component **306** can confirm that the geographic area is experiencing (or has experienced) heavy rains or the like. Of course, this is a single example of determining an event using the event identification component **306**, generally illustrating that the event determination component can receive information from disparate sources to determine the occurrence, or probability of occurrence, of some event. The event can include both the actual event, e.g., flood, and any other associated information. Such associated information can include, but is not limited to, an

area impacted by the event, users affected by the event, a duration (or likely duration) of the event, and/or other information.

The message generation component **308** includes functionality to generate a message based on the event determined by the event identification component. For example, the message generation component **308** can include or access a database that stores pre-generated messages and associations of those messages with events. For instance, and continuing the example above, the message generation component **308** may generate message text such as "Flood in Geographic Area A," where "Geographic Area A" corresponds to the flood locale determined by the event identification component **306**. In addition to generating the text associated with the message, the message generation component **308** can also include functionality to associate one or more recipients with the message. For instance, if contacts to the contact center **200** are assigned based on geographical proximity to a source of the contact, the recipients for the message in the foregoing example may be the representative client devices **210** proximate the geographic area associated with the flood. In other examples, contacts to the contact center **200** may be routed based on policy-type, and the message generation component **308** may identify the recipients for the example message as the representative client devices **210** associated with representatives providing services related to policies impacted by the flood. Of course, these are for example only.

In some examples, the message handling component **310** may include functionality to receive message information, e.g., from the message generation component **308** and facilitate display of the message on user devices associated with the appropriate recipients. In some examples, the message handling component **310** includes functionality to generate and/or maintain a message queue, such as the message queue **128**. The message handling component **310** can receive requests from the representative client devices **210** and/or the administrator client devices **212** and determine whether the device(s) are to receive a message.

Although not illustrated in FIG. **3**, the message handling component **310** may also include functionality ascribed in FIG. **1** to the messaging component **126**. For instance, the message handling component **310** may be the messaging component **126** and/or include functionality associated with the messaging component **126**. For example, and without limitation, the message handling component **310** can facilitate display of the message generation user interface **112** and/or receive the message information **124** from the administrator device **104**. Thus, the message handling component **310** can receive messages generated by the message generation component **308** and/or by the administrator client devices **212**. The message handling component **310** can also distribute messages to the representative client devices **210** and/or the administrator devices **212**. For instance, the message handling component **310** can broadcast or otherwise transmit messages to intended recipients.

In some examples, messages generated by the message generation component **308** may be presented for approval prior to being stored by, e.g., in the message queue **128**, and/or distributed, e.g., broadcast, by the message handling component **310**. For instance, messages generated by the message generation component **308** may be presented to an administrator, e.g., via one of the administrator devices **212**, for approval for sending. In at least some instances, messages generated by the message generation component **308** may be included in the messages **118**. Also in examples, messages generated by the message generation component **308** may be presented to an administrator with a confidence associated with the message. The confidence may be a confidence value, e.g., a probability, associated with an event determined by the event identification component **306**, with the content or correctness of the message, with recipients indicated as being targeted with the message, and/or with other aspects of the message.

FIG. **4** illustrates an example client software framework for one of the representative client devices **210**. The software components depicted in FIG. **4** may implement the various functionalities of the representative client device **210** operating within a contact center, such as the contact center **200**. Using a software framework similar or identical to that depicted in this example, a desktop application **402** and/or other software components running on the client device **210** may receive and execute interactive sessions with customer devices **208** via a contact application **404**. The desktop application **402** also may interact with various other internal and external components associated with the contact center **200** to support common queuing from internal and external sources, and integrated contact center monitoring and modeling, as described herein.

The example software framework shown in FIG. **4** may be implemented as a thick client framework. As a result of using a thick client framework like that depicted in this example, a larger portion of the processing tasks to provide the representative functionality in the contact center may be performed on the representative client device **210**, while less of the processing tasks are performed on the servers of the contact center. In some examples, a thick client framework similar or identical to that shown in FIG. **4** may provide technical advantages in executing the multimedia components and processing the bandwidth intensive communication sessions of the representative client device **210**.

The desktop application **402** may be installed on the representative client device **210** to initiate and execute interactive sessions for the contact center. As noted above, communication sessions via the contact center allow an organization representative on a representative client device **210** to interact with a customer on external customer devices **208**, using any of the supported communication types (e.g., voice, messaging/chat, email, video, social media, etc.). To enable communication sessions, the desktop application **402** may access and run a contact application **404** that connects to an external communication service, like the communications service providers **204**A-**204**E, receive and transmit user input from the local representative, and output the customer multimedia data received from the external communication service.

In some examples, the desktop application **402** may be a multi-process (or multi-threaded) application. For instance, each of the components **404**-**412** depicted within the desktop application **402** may correspond to a separate computing process. The desktop application may include functionality to perform queue control, contract tracking, operational metrics, and broadcast functionality for the desktop application **402**. As discussed herein in more detail, in some cases the desktop application **402** facilitates retrieval and running of a containerized application as the contact application **404**. The containerized application may be received from a server as a container image with packaged code along with an IID identifier. The desktop application may include functionality to unpack and launch the contact application on the representative client device **210** to provide the representative functionality. The browser process **406** may be a lightweight (or thin) customized browser. For instance, the browser process **406** may execute the initial logic of the desktop

application **402**, including managing the representative login and authentication functions, after which an appropriate application may be retrieved and downloaded from a server of the contact center, e.g., as the contact application **404**. Additionally, as shown in this example, the desktop application **402** may include a separate client integration process **408**, a communication delivery process **410**, and a presence process **412**.

As shown in this example, the software framework of the representative client device **210** may include a number of additional software components, including user interfaces **414**, tools **416**, data sources **418**, API integration components **420**, a messaging/application retrieval component **422** and/or a communication façade **424**.

In some examples, the desktop application **402** may use the API integration components **420** to access the APIs exposed by the operating system of the representative client device **210**. Such implementations may provide technical advantages over other contact center client applications. For instance, web browser-based and other thin client applications for contact center representatives may be unable to access the native APIs exposed by the client device. In contrast, the thick client framework examples described herein may provide advantages of web-based thin clients (e.g., uses of web-based techniques and protocols such as JS, CSS, and HTTPS to communicate with external services **203** during interactive sessions), along with advantages of thick clients including access to the file system and native APIs of the representative client device **210**. In some examples, the desktop application **402** may record various state data of the representative client device **210** before, during, and/or after an interactive session with a customer (e.g., other open applications and windows, user behaviors and actions performed by the representative on the representative client device **210**, etc.). The state data of the representative client device **210** may be analyzed along with the corresponding data associated with the interactive session (e.g., interaction transcript, customer sentiment, outcome/resolution of the contact, etc.), to provide more robust data for analyzing interactive sessions and representative performance in the contact center environment. Additionally, the multi-threaded thick client framework may improve the technical and/or digital quality of multimedia communication sessions (e.g., voice and/or video) provided via the contact center. For instance, the desktop application **402** may operate a first computing process (e.g., a thin web browser) to execute the application logic and may launch a second computing process to handle a new interactive multimedia session with a customer. When the representative client device **210** includes multiple processors, the desktop application **402** also may assign the second computing process handling the communication session to a particular processor based on the current processor loads, network traffic, and/or quality thresholds for multimedia sessions, in order to assure a higher-quality multimedia session with dedicate hardware, memory, and software resources.

The messaging/application retrieval **422** and the communication façade **424** may be software objects that common interfaces between the desktop application **402** and, respectively, the contact center **20** and the external communication services **203**. In some examples, the messaging/application retrieval component **422** and the communication façade **424** may be implemented as services running on the representative client device **210**, which expose APIs that may be invoked by an internal application (e.g., desktop application **402**) and/or external applications (e.g., communication services **204**). The messaging/application retrieval component **422** and the communication façade **424** may be part of the integration layer **216** discussed above. Additionally, although the messaging/application retrieval component **422** and the communication façade **424** may execute on the representative client device **210** as shown in this example, one or both the messaging/application retrieval component **422** and the communication façade **424** may be implemented outside of the representative client device **210** in other examples.

The messaging/application retrieval component **422** includes functionality allowing the desktop application **402** to query for new messages. For instance, the messaging/application retrieval component **422** may query the message queue **128** for new messages. In some examples, such querying may occur when the representative using the representative client device **210** logs into the desktop application, when the representative client device **210** requests an application, e.g., as the contact application, when a new contact interaction is begun, upon completion of a contact interaction, or at any other time. The messaging/application retrieval component **422** can institute conventional messaging formats and protocols, such as SMS, MMS, or the like.

The communication façade **424** also may provide a common interface between the desktop application **402** and/or the contact application **404** and the external communication servers **204**A-**204**E. The communication façade **424** includes the capabilities to deliver media (e.g., text, audio data, video data, etc.) to and from the representative client device **210** during an interactive session with a customer. In some scenarios, after the representative user begins work with the desktop application **402** (e.g., authenticates and/or logs-in), the desktop application **402** may transmit a device registration to one or more of the external services **203**. The device registration may include an IP address associated with the communication façade **424**. The external services **203** may transmit media content to the communication façade **424** during subsequent interactive sessions, and the communication façade **424** may relay the media content to the desktop application **402**, e.g., via the contact application **404** for presentation to the user.

FIG. **5** shows an example computer architecture for a computer **500** capable of executing program components for implementing the functionality described herein. The computer architecture shown in FIG. **5** may correspond to the systems and components of a server computer, workstation, desktop computer, laptop, tablet, network appliance, mobile device (e.g., tablet computer, smartphone, etc.), or other computing device, and can execute any of the software components described herein. The computer **500** may, in some examples, correspond to any of the computing systems or devices described above, such as the representative client devices **210**, administrator client devices **212**, operations system(s) **114**, internal servers, and/or any other computing devices described herein. It will be appreciated that in various examples described herein, a computer **500** might not include all of the components shown in FIG. **5**, can include additional components that are not explicitly shown in FIG. **5**, and/or may utilize a different architecture from that shown in FIG. **5**.

The computer **500** includes a baseboard **502**, or "motherboard," which may be a printed circuit board to which a multitude of components or devices are connected by way of a system bus or other electrical communication paths. In one illustrative configuration, one or more central processing units ("CPUs") **504** operate in conjunction with a chipset **506**. The CPUs **504** can be standard programmable proces-

sors that perform arithmetic and logical operations necessary for the operation of the computer **500**.

The CPUs **504** perform operations by transitioning from one discrete, physical state to the next through the manipulation of switching elements that differentiate between and change these states. Switching elements generally include electronic circuits that maintain one of two binary states, such as flip-flops, and electronic circuits that provide an output state based on the logical combination of the states of one or more other switching elements, such as logic gates. These basic switching elements can be combined to create more complex logic circuits, including registers, adders-subtractors, arithmetic logic units, floating-point units, and the like.

The chipset **506** provides an interface between the CPUs **504** and the remainder of the components and devices on the baseboard **502**. The chipset **506** can provide an interface to a RAM **508**, used as the main memory in the computer **500**. The chipset **506** can further provide an interface to a computer-readable storage medium such as a ROM **510** or non-volatile RAM ("NVRAM") for storing basic routines that help to startup the computer **500** and to transfer information between the various components and devices. The ROM **510** or NVRAM can also store other software components necessary for the operation of the computer **500** in accordance with the configurations described herein.

The computer **500** can operate in a networked environment using logical connections to remote computing devices and computer systems through a network, such as the network **518**, which may be similar or identical to the network(s) **206** discussed above. The chipset **506** also may include functionality for providing network connectivity through a Network Interface Controller (NIC) **512**, such as a gigabit Ethernet adapter. The NIC **512** is capable of connecting the computer **500** to other computing devices over the network **518**. It should be appreciated that multiple NICs **512** can be present in the computer **500**, connecting the computer to other types of networks and remote computer systems. In some instances, the NICs **512** may include at least on ingress port and/or at least one egress port.

The computer **500** can also include one or more input/output controllers **516** for receiving and processing input from a number of input devices, such as a keyboard, a mouse, a touchpad, a touch screen, an electronic stylus, or other type of input device. Similarly, an input/output controller **516** can provide output to a display, such as a computer monitor, a flat-panel display, a digital projector, a printer, or other type of output device.

The computer **500** can include one or more storage device(s) **520**, which may be connected to and/or integrated within the computer **500**, that provide non-volatile storage for the computer **500**. The storage device(s) **520** can store an operating system **522**, data storage systems **524**, and/or applications **526**, which are described in more detail herein. The storage device(s) **520** can be connected to the computer **500** through a storage controller **514** connected to the chipset **506**. The storage device(s) **520** can consist of one or more physical storage units. The storage controller **514** can interface with the physical storage units through a serial attached SCSI ("SAS") interface, a serial advanced technology attachment ("SATA") interface, a fiber channel ("FC") interface, or other type of interface for physically connecting and transferring data between computers and physical storage units.

The computer **500** can store data on the storage device(s) **520** by transforming the physical state of the physical storage units to reflect the information being stored. The specific transformation of physical state can depend on various factors, in different embodiments of this description. Examples of such factors can include, but are not limited to, the technology used to implement the physical storage units, whether the storage device(s) **520** are characterized as primary or secondary storage, and the like.

For example, the computer **500** can store information to the storage device(s) **520** by issuing instructions through the storage controller **514** to alter the magnetic characteristics of a particular location within a magnetic disk drive unit, the reflective or refractive characteristics of a particular location in an optical storage unit, or the electrical characteristics of a particular capacitor, transistor, or other discrete component in a solid-state storage unit. Other transformations of physical media are possible without departing from the scope and spirit of the present description, with the foregoing examples provided only to facilitate this description. The computer **500** can further read information from the storage device(s) **520** by detecting the physical states or characteristics of one or more particular locations within the physical storage units.

In addition to the storage device(s) **520** described above, the computer **500** can have access to other computer-readable storage media to store and retrieve information, such as program modules, data structures, or other data. It should be appreciated by those skilled in the art that computer-readable storage media is any available media that provides for the non-transitory storage of data and that can be accessed by the computer **500**. In some examples, the various operations performed by a computing system (e.g., representative client devices **210**, internal servers **302**, etc.) may be supported by one or more devices similar to computer **500**. Stated otherwise, some or all of the operations described herein may be performed by one or more computers **500** operating in a networked (e.g., client-server or cloud-based) arrangement.

By way of example, and not limitation, computer-readable storage media can include volatile and non-volatile, removable and non-removable media implemented in any method or technology. Computer-readable storage media includes, but is not limited to, RAM, ROM, erasable programmable ROM ("EPROM"), electrically-erasable programmable ROM ("EEPROM"), flash memory or other solid-state memory technology, compact disc ROM ("CD-ROM"), digital versatile disk ("DVD"), high definition DVD ("HD-DVD"), BLU-RAY, or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to store the desired information in a non-transitory fashion.

As mentioned briefly above, the storage device(s) **520** can store an operating system **522** utilized to control the operation of the computer **500**. In some examples, the operating system **522** comprises a LINUX operating system. In other examples, the operating system **522** comprises a WINDOWS® SERVER operating system from MICROSOFT Corporation of Redmond, Washington. In further examples, the operating system **522** can comprise a UNIX operating system or one of its variants. It should be appreciated that other operating systems can also be utilized. The storage device(s) **520** can store other system or application programs and data utilized by the computer **500**.

In various examples, the storage device(s) **520** or other computer-readable storage media is encoded with computer-executable instructions which, when loaded into the computer **500**, transform the computer from a general-purpose computing system into a special-purpose computer capable

of implementing various techniques described herein. These computer-executable instructions transform the computer **500** by specifying how the CPUs **504** transition between states, as described above. In some examples, the computer **500** may have access to computer-readable storage media storing computer-executable instructions which, when executed by the computer **500**, perform the various techniques described herein. The computer **500** can also include computer-readable storage media having instructions stored thereupon for performing any of the other computer-implemented operations described herein.

As illustrated in FIG. **5**, the storage device(s) **520** may store one or more data storage systems **524** configured to store data structures and other data objects. Additionally, the software applications **526** stored on the computer **500** may include one or more client applications, services, and/or other software components. For example, for a representative client device **210**, application(s) **526** may include client applications **202**, queue and communication facades **422** and **424**, and/or other software components described in reference to FIG. **2**. For an example internal server, the applications **526** may include the event identification component **306**, the message generation component, and the message handling component **310** described with reference to FIG. **3**.

FIG. **6** is a flow diagram illustrating a process **600** of transmitting messages in a contact center. Aspects of the process **600** may be implemented by the contact center server **102**, the contact center **200**, and/or other aspects described herein. However, the contact center server **102** and the contact center **200** are not limited to performing the process **600**.

At an operation **602**, the process **600** includes causing display of an administrator UI. As detailed herein, a contact center computing architecture can facilitate interaction of customers with representatives and/or administrators associated with a business or other organization. The contact center computing architecture can also coordinate communication between administrators and representatives. In one example, the operation **602** can include presenting the message generation user interface **112** on an administrator device, such as the administrator device **104** and/or the administrator device(s) **104**. In examples, the message generation user interface can facilitate a number of user inputs, e.g., by an administrator.

At an operation **604**, the process **600** includes receiving, via input at the administrator UI, message information including a message and one or more recipients. For example, the message generation user interface **112** shown in FIG. **1** includes a list of messages **118** from which an administrator can choose one or more messages for distribution. The message generation user interface **112** also includes a list of recipients **120** that may be selected by the administrator to receive the message(s). In some instances, the administrator UI may provide functionality to directly input new messages, such as via text box, dictation, or the like. Also in examples, and as described in connection with FIG. **3**, messages may be automatically generated, e.g., by the messaging system **302** and presented for consideration by the administrator.

At an operation **606**, the process **600** includes adding message information to a message queue. For example, and in response to an administrator selection of a message and recipients for that message, the administrator client device may generate message information, such as the message information **124**. The message information **124** may include information in addition to the message and recipients, such as duration information and/or other information. The message information **124** may be stored by a centralized application or server, such as the contact center server **12** for subsequent distribution to the appropriate recipients. In the example of FIG. **1**, message information is stored in the message queue **128**.

At an operation **608**, the process **600** includes receiving, from a representative device, a request for new messages. For example, a representative device running a desktop or background application associated with the contact center server may send requests for new messages automatically, e.g., when representative logs into their device, at a predetermined frequency, the occurrence of some event, or otherwise.

At an operation **610**, the process includes determining whether the representative device is associated with one or more recipients for a message in the message queue. Without limitation, the operation **610** can include the contact center server determining whether the recipient device from which a request for new messages was received is associated with a recipient of each of the messages stored in the message queue **128**.

If, at the operation **610** it is determined that a request for messages is from a representative device that is associated with a recipient for one of the messages in the message queue, and operation **612** the messages cause to be displayed on the representative device, via the desktop application. For instance, the message may be displayed as a banner or other prominent display via the user's desktop application, without the need for the representative to be running a specialized messaging or communication app. The functionality of message generation and distribution is integrated into the desktop application, which is hosted at the contact center, and via which all other operations, including accessing applications or the like, are undertaken.

Alternatively, if at the operation **610** is determined that a request for messages is not from a representative device is associated with a recipient for one of the messages in the message queue, at an operation **614** the process **600** determines that there are no messages for the representative device.

The foregoing process **600** provides an example process by which messages are generated and distributed in a contact center environment in which administrators can provide important information directly to representatives, e.g., without the need for the representatives to be running a specific application and/or checking that application for new messages. According to methods described herein, messages can be broadcast to all appropriate representatives without being bound by limitations and requirements of those conventional messaging applications.

FIG. **7** is a flow diagram illustrating an example process **700** of automatically generating messages for distribution to administrators and/or representatives operating in a contact center environment. As discussed below, the techniques and operations of process **700** may be performed by various systems and components within the contact center computing environments **100**, **200** and **300**, such as the contact center server **102**, the messaging system **302**, and/or other software components of the contact center described herein.

At an operation **702**, the process **700** includes receiving data from a communications service provider and/or additional data source. Examples detailed herein, a contact center may facilitate interaction of customer with a representative associated with a business or other organization. The contact center architecture may utilize a number of different applications for facilitating such interactions. In at least some examples, the contact center can leverage third-

party communication service providers to interface with customers in different ways. Such interactions may be recorded and/or otherwise generate data, including data about the customer, about the interaction, about a product or service for which the customer is reaching out to the contact center, or the like. In at least one example, the operation **702** can be carried out by the data feed component **304** of the messaging system **302**. Additional sources of data may include the internal data sources **312** and/or the external data sources **314**.

In operation **704**, the process **700** can include determining whether the data indicates an event. For example, a model, such as a heuristic model and/or a machine learned model may process the data received at the operation **702** and determine one or more events from the data. Without limitation, the event identification component **306** of the messaging system **302** can include information from the data feed computer **304**, data from the internal data sources **312**, and or data from the external data sources **314** and identify events. In at least one example, the event identification component **306** may include a machine learning model that is trained on previous data and events identified from that data. In some examples, the event identification component **306** can determine a probability that data suggests an event, context surrounding that event, and/or other information about the event.

If, at the operation **704**, no event is determined, the process **700** may return to the operation **702** to continue analyzing new data generated via external sources, via interactions with the contact center, and/or otherwise. However, if at the operation **704** it is determined that the data does indicate an event, at an operation **706**, the process **700** determines a message associated with the event. In some examples, specific events AB determined that the operation **704**, and a contact center may include predetermined messages associated with such events. For instance, a contact center server may store a lookup table or other database that correlates events with messages. In other examples, information about the event determined that the operation **704** may be presented to a user of the system, such as an administrator, at the operation **706**. For instance, the administrator may be presented with a description of the event, contact associated with the event, and/or other information. Using this information, the administrator may generate a message, such as via a message generation user interface **112**.

At an operation **708**, the process **700** includes determining one or more recipients for the message. In some examples, the recipients may be identified by an administrator, as described herein. In other examples, recipients for the message may be identified via a model. For instance, the message generation component **308** may identify appropriate recipients for message, e.g., based on data about the event type, about aspects of the event, and/or the like. In one nonlimiting example, the message generation component **308** can determine that representatives within a geographic area should be recipients of a message associated with an event happening at or near that geographic area.

In operation **710**, the process **700** includes storing the message and the one or more recipients. For example, information about the message and/or the recipients, as well as other information, including but not limited to message duration information, confidence data associated with the message and/or the recipients, and/or other information, may be stored in a database accessible by aspects of the contact center **200**. For instance, message and/or the recipients may be stored in message queue, such as the message queue **128**. Without limitation, messages stored at the operation **710** may be distributed according to the process **600** discussed above.

In accordance with the foregoing, aspects of this disclosure describe message generation and distribution in a contact center environment. Aspects of the environment include ensuring that important messages are received by users of the system with limited to no responsibility on part of the users for seeing those messages. For instance, representatives using a contact center environment to respond to customer queries may benefit from the processes described herein by receiving important information without taking affirmative actions to install, open, and or check a separate messaging application. This may be particularly important in a contact center environment in which representatives may be using different customer interfacing applications.

In some instances, one or more components may be referred to herein as "configured to," "configurable to," "operable/operative to," "adapted/adaptable," "able to," "conformable/conformed to," etc. Those skilled in the art will recognize that such terms (e.g., "configured to") can generally encompass active-state components and/or inactive-state components and/or standby-state components, unless context requires otherwise.

As used herein, the term "based on" can be used synonymously with "based, at least in part, on" and "based at least partly on."

As used herein, the terms "comprises/comprising/comprised" and "includes/including/included," and their equivalents, can be used interchangeably. An apparatus, system, or method that "comprises A, B, and C" includes A, B, and C, but also can include other components (e.g., D) as well. That is, the apparatus, system, or method is not limited to components A, B, and C.

While the invention is described with respect to the specific examples, it is to be understood that the scope of the invention is not limited to these specific examples. Since other modifications and changes varied to fit particular operating requirements and environments will be apparent to those skilled in the art, the invention is not considered limited to the example chosen for purposes of disclosure, and covers all changes and modifications which do not constitute departures from the true spirit and scope of this invention.

Although the application describes embodiments having specific structural features and/or methodological acts, it is to be understood that the claims are not necessarily limited to the specific features or acts described. Rather, the specific features and acts are merely illustrative some embodiments that fall within the scope of the claims of the application.

The invention claimed is:

1. A method comprising:

providing, by a contact center server and to a first computing device, a containerized application configured to execute interactive communication sessions on the first computing device;

receiving, by the contact center server, message data associated with a message for distribution to one or more recipients;

receiving, by the contact center server, a request for new messages from the first computing device, at a time when the first computing device is executing the containerized application and a separate desktop application configured to send the request for new messages based at least in part on an output of the containerized application by the first computing device;

determining, by the contact center server, that the first computing device is associated with a recipient of the one or more recipients; and

based at least in part on the request, causing, by the contact center server, the message to be displayed via the desktop application of the first computing device.

2. The method of claim **1**, wherein

the desktop application is configured to execute on the first computing device within a browser-based process, and

the containerized application is configured to execute on the first computing device within a non-browser process configured to access one or more native application programming interfaces (APIs) of the first computing device.

3. The method of claim **1**, wherein the desktop application of the first computing device is configured to automatically transmit the request for new messages in response to at least one of:

an installation of the containerized application on the first computing device;

a beginning of a new interactive session by the containerized application; or

an ending of an interactive session by the containerized application.

4. The method of claim **1**, wherein the contact center server hosts a plurality of containerized applications including the containerized application, and wherein the method further comprises:

providing, to a second computing device, a second containerized application image including a second containerized application configured to execute interactive communication sessions on the second computing device;

receiving a second request for new messages from the second computing device, at a second time when the second computing device is executing the second containerized application and the desktop application;

determining that the second computing device is associated with a second recipient of the one or more recipients; and

causing the message to be displayed on the second computing device, via the desktop application.

5. The method of claim **1**, further comprising:

determining, by the contact center server, a message duration associated with the message; and

causing the message to be displayed via the desktop application of the first computing device for the message duration.

6. The method of claim **1**, further comprising:

receiving event data associated with an event;

providing the event data as input to a machine learning model; and

generating the message, based at least in part on an output of the machine learning model.

7. A computer system comprising:

one or more processors; and

one or more non-transitory computer-readable media storing computer-executable instructions that, when executed, cause the one or more processors to perform operations comprising:

providing, to a first computing device, a containerized application configured to execute interactive communication sessions on the first computing device;

receiving message data associated with a message for distribution to one or more recipients;

receiving a request for new messages from the first computing device, at a time when the first computing device is executing the containerized application and a separate desktop application configured to send the request for new messages based at least in part on an output of the containerized application by the first computing device;

determining that the first computing device is associated with a recipient of the one or more recipients; and

causing the message to be displayed via the desktop application of the first computing device.

8. The computer system of claim **7**, further comprising:

providing, to a second computing device, a second containerized application configured to execute interactive communication sessions on the second computing device;

receiving a second request for new messages from the second computing device, at a second time when the second computing device is executing the second containerized application and the desktop application;

determining that the second computing device is associated with a second recipient of the one or more recipients; and

causing the message to be displayed on the second computing device, via the desktop application.

9. The computer system of claim **7**, further comprising:

determining a message duration associated with the message; and

causing the message to be displayed via the desktop application of the first computing device for the message duration.

10. The computer system of claim **7**, further comprising:

receiving event data associated with an event;

providing the event data as input to a machine learning model; and

generating the message, based at least in part on an output of the machine learning model.

11. A computing device, comprising:

one or more processors; and

one or more non-transitory computer-readable media storing computer-executable instructions that, when executed, cause the one or more processors to perform operations comprising:

receiving a containerized application image from a contact center server, the containerized application image including a containerized application configured to execute interactive communication sessions on the computing device;

unpacking the containerized application image and executing the containerized application on the computing device;

determining, by a desktop application executing a computing device, a request for new messages, based at least in part on an output of the containerized application;

transmitting, by the desktop application, the request for new messages to the contact center server;

receiving a message from the contact center server, wherein the message is associated with at least one of the containerized application or a user of the computing device; and

displaying the message on the computing device via the desktop application.

12. The computing device of claim **11**, wherein

the desktop application is configured to execute on the computing device within a browser-based process, and

the containerized application is configured to execute on the computing device within a separate non-browser process.

13. The computing device of claim **12**, wherein

the containerized application is configured to access at least one of:

a native application programming interface (API) of the computing device; or

a file system of the computing device.

14. The computing device of claim **11**, wherein the desktop application is configured to automatically transmit the request for new messages to the contact center server in response to at least one of:

an installation of the containerized application on the computing device;

a beginning of a new interactive session by the containerized application; or

an ending of an interactive session by the containerized application.

15. The computing device of claim **11**, wherein

the containerized application is configured to use a first web-based protocol to provide interactive communication sessions via an external service; and

the desktop application is configured to use a second messaging protocol to request and receive messages from the contact center server.

16. The computing device of claim **15**, wherein communications for the interactive communication sessions provided by the containerized application are transmitted via network path that excludes the contact center server.

17. The computing device of claim **11**, the operations further comprising:

receiving a message duration associated with the message; and

causing the message to be displayed via the desktop application for the message duration.

18. A method comprising:

receiving, by a computing device, a containerized application image from a contact center server, the containerized application image including a containerized application configured to execute interactive communication sessions on the computing device;

unpacking the containerized application image and executing the containerized application on the computing device;

determining, by a desktop application executing a computing device, a request for new messages, based at least in part on an output of the containerized application;

transmitting, by the desktop application, the request for new messages to the contact center server;

receiving a message from the contact center server, wherein the message is associated with at least one of the containerized application or a user of the computing device; and

displaying the message on the computing device via the desktop application.

19. The method of claim **18**, wherein

the desktop application is configured to execute on the computing device within a browser-based process, and

the containerized application is configured to execute on the computing device within a separate non-browser process.

20. The method of claim **19**, wherein

the containerized application is configured to access at least one of:

a native application programming interface (API) of the computing device; or

a file system of the computing device.

21. The method of claim **18**, wherein the desktop application is configured to automatically transmit the request for new messages to the contact center server in response to at least one of:

an installation of the containerized application on the computing device;

a beginning of a new interactive session by the containerized application; or

an ending of an interactive session by the containerized application.

22. The method of claim **18**, wherein

the containerized application is configured to use a first web-based protocol to provide interactive communication sessions via an external service; and

the desktop application is configured to use a second messaging protocol to request and receive messages from the contact center server.

23. The method of claim **22**, wherein communications for the interactive communication sessions provided by the containerized application are transmitted via network path that excludes the contact center server.

24. The method of claim **18**, further comprising:

receiving a message duration associated with the message; and

causing the message to be displayed via the desktop application for the message duration.

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